The Clean Water People

Anne Spray Kinney
Executive Director

March 15, 2001

Darrell Bazzell, Secretary
Wisconsin Department of Natural Resources
101 South Webster Street
PO Box 7921
Madison, WI 53707

Dear Secretary Bazzell:

The Milwaukee Metropolitan Sewerage District is very pleased that the Wisconsin Department of Natural Resources "Sewer Overflows in Wisconsin—A Report to the Natural Resources Board" has validated that MMSD has one of the best performing sewer systems in the United States.

"MMSD certainly has a state-of-the-art system.
A similar [low] level of [sanitary sewer overflows] and [combined sewer overflows] control occurs in few, if any, metropolitan areas of more than one million people in the United States."
– DNR report on statewide sewer overflows

I want to thank you for your department's diligence in compiling the report and allowing MMSD staff to provide input. This is a complicated subject that can be easily misunderstood and misconstrued. I have attached the District's specific comments on the report.

MMSD's enviable record of permit compliance and commitment to an additional $900 million in capital improvements demonstrate that we share the common goal of doing everything feasible to avoid sewer overflows. Sewer overflows are a function of heavy rainfall, something the Milwaukee area has seen more than its share of in recent years. As you know, if sewers were not allowed to overflow under extreme conditions, untreated wastewater would back up into residents' basements, which is an unacceptable alternative. The District looks forward to continuing to work with the DNR on efforts to reduce the risk of sewer overflows.

Sincerely,

Anne Spray Kinney

Anne Spray Kinney
Executive Director

Enclosure

cc: MMSD Commissioners
Mayors and Village Presidents of communities served by MMSD

dg/d/mydocs/corres

Milwaukee Metropolitan Sewerage District
260 W. Seeboth Street, Milwaukee, WI 53204-1446
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Milwaukee Metropolitan Sewerage District

MMSD's Comments on "Sewer Overflows in Wisconsin— A Report to the Natural Resources Board"

Deep Tunnel System

We are pleased the DNR has confirmed what MMSD has been saying all along - the Deep Tunnel system has done what it was designed to do -- greatly reduce sewer overflows. The report found no operational problems with the Deep Tunnel system or the way MMSD operates the system. This validates the work undertaken by MMSD and its communities as part of the Water Pollution Abatement Program in the 1980s and early 1990s. It also further confirms that the system is operating properly and the focus of future efforts needs to be on reducing infiltration and inflow, or rainwater, entering the local sanitary sewer systems.

Prior to the Deep Tunnel, there were 40 to 60 overflows a year. Through 2000, there had been on average about 2.5 overflows a year *(see Attachment 1)*, far fewer than any major metropolitan area in the United States *(see Attachment 2)*. In all, the Deep Tunnel system has prevented more than 227 overflows and kept about 37 billion gallons of untreated wastewater from entering Milwaukee-area waterways.

Infiltration and Inflow (Rainwater leaking into sanitary sewer system)

"It is important to point out that excessive I/I originates in the sanitary sewage collection systems of the individual communities in the MMSD service area. Therefore, even though the SSO occurs from discharge points in the MMSD's interceptors, the individual communities will play a significant role in future work to prevent SSOs."
-DNR Report

The finding in the report that the main cause of the sanitary sewer overflows in recent years is infiltration and inflow, or rainwater, entering local sanitary sewer systems is consistent with what the District and the communities it serves have determined. This is also consistent with the direction MMSD set in its DNR-approved 2010 Facilities Plan, which identified the correction of infiltration and inflow problems as one of the most significant methods for reducing the risk of sewer overflows.

MMSD tests have shown that wet weather flow in some local sewers in Milwaukee-area communities is between 20 and 40 times the normal dry weather flow. An acceptable ratio is six times the normal dry weather flow, as determined by a technical advisory team of engineers from the communities served by the District. The DNR's position should serve as a wake up call to all communities served by MMSD as well as communities throughout the state, that the issue of infiltration and inflow must be addressed.

Clearly, the focus of DNR, MMSD, and the communities served by the District must continue to be on reducing the amount of rainwater entering the sewer systems as the way to reduce the risk of basement backups and sewer overflows.

The District and its communities have made excellent progress to date. MMSD is funding eight demonstration projects in its communities aimed at identifying the most effective methods of reducing infiltration and inflow. The results will be shared with all the communities to help them implement effective infiltration and inflow reduction programs. For example, preliminary inspection work in the Village of Brown Deer found that 40 percent of the first 128 homes inspected by the village were found to have leaking laterals *(see Attachment 3)*.

The DNR report and the preliminary results from Brown Deer raise questions for the DNR to consider:

- Are the DNR and the State of Wisconsin willing to be a partner in efforts to reduce infiltration and inflow by providing state funding to communities working to reduce sewer overflows?
- Are the DNR and the State of Wisconsin willing to provide technical assistance to these communities?
- Will the DNR support the use of state funds to help pay for municipal efforts to remove infiltration and inflow sources on private property rather than placing the full cost burden on local homeowners?

We are confident that progress will be accelerated as many of the communities, with MMSD support, implement upgrades in their systems and work with homeowners to reduce private property sources of clear water. But the State must address the funding issue.

Operational Changes

We are pleased to report that all of the operational studies and changes DNR staff suggested to increase the capacity of the District's treatment plants and conveyance system are underway or are already completed. Operators utilize all steps possible to maximize the treatment capacity of the two treatment plants and the storage capacity of the Deep Tunnel system. In addition, the District is upgrading its existing operating system with a state-of-the-art "real time" control system that will provide updated information on system performance every five to 15 minutes. The information will help the District maximize existing system capacity during heavy rainstorms.

In-Plant Diversions

The report validates what MMSD has said – that in-plant diversions, which meet final permit effluent requirements, are an effective way to handle higher flow during heavy rainstorms. The report recommends that the District "maximize the use of in-plant diversions around the secondary treatment system at Jones Island" during major rain storms. The District's operators are already taking all necessary steps to ensure that as much flow as possible is either stored in the Deep Tunnel System or treated at the treatment plants. An in-plant diversion is standard operating procedure for a wastewater treatment plant trying to maximize the amount of wastewater treated. The total flow, including diverted flow, receives extensive treatment, including disinfection and dechlorination and meets all permit requirements. The report should thus put to rest the myth that the plants release "partially-treated" sewage into the lake.

Sampling

The report recommends a study to confirm that MMSD sampling times produce results that are representative of the amount of fecal coliform discharged from the system. This request apparently resulted from the recent misleading media reports. Attached is a MMSD report *(see Attachment 4)* demonstrating that MMSD's procedures for sampling fecal coliform between 3 a.m. and 5 a.m. produce representative results. The report shows: 1) that the treatment plant flows at 3 a.m. to 5 a.m. are equal to or higher than the average daily plant flows; 2) that flows entering the plant are treated for about 12 hours before sampling and discharge; and 3) it takes between 30 minutes and 8 hours for flows to reach the treatment plants depending on the distance of the individual communities from the plants. This means that samples taken between 3 a.m. and 5 a.m. were discharged to the system from between 8 a.m. and 10 p.m. the previous day when the maximum amounts of fecal discharge are expected to be discharged to the system.

Lastly, samples collected between 3 a.m. and 5 a.m. were compared with samples taken later on the same day. The test comparisons actually indicate slightly higher values for fecal coliform from the samples taken between 3 a.m. and 5 a.m., again proving the point that the current sample methods yield representative data.

Future capital projects

The report recognizes that the District has committed to spend more than $900 million over the next several years to rehabilitate, replace, and build new interceptor sewers, which will provide additional capacity, and to implement several important flood management projects. The projects include:

- Twenty-five relief sewer projects, treatment plant modifications, and control and information system improvements as recommended in the District's 2010 Facilities Plan, approved by the DNR in 1998 ($350 million);
- Completion of flood management programs to significantly reduce infiltration and inflow by keeping flood waters from entering the sanitary sewer system, such as the Menomonee River Flood Control Plan and the Lincoln Creek Environmental Restoration and Flood Control Project ($250 million);
- Completion of additional programs to reduce infiltration and inflow, or clear water, entering the local sanitary sewer systems ($17 million); and

- Rehabilitation and replacement of interceptor sewers as part of the Central Metropolitan Interceptor Sewer System ($300 million).

Along with infiltration and inflow reduction efforts by the local communities, these improvements will further reduce separate sewer overflows and enhance the efficiency and capacity of the District's system.

Sanitary Sewer Overflows

"SSO discharges are not authorized by MMSD's permit and the general permit applicable to communities tributary to MMSD, unless the discharge was due to equipment damage or power interruption, was necessary to protect life and property, or was caused by excessive storm drainage runoff."
-DNR Report

The report provided a preliminary assessment of the small number of sanitary sewer overflows that have occurred since the Deep Tunnel system was put in operation. When DNR staff reviews the data further, we believe they will reach the same conclusion that District staff has, which is that these occurred during extreme storms that exceed the design level or other criteria that were approved by the DNR as part of the District's 2010 Facilities Plan. The specific details of each overflow were reported to the DNR at the time each occurred, as per the District's permit.

Planning Requirements Beyond 2010

We are very concerned that requirements the DNR is considering applying to MMSD are more stringent than those it applies to all other wastewater treatment systems in the State of Wisconsin.

There were 167 sewer system overflows in Wisconsin in 2000, only five of which occurred in MMSD's system. If the DNR imposes an absolute zero sanitary sewer overflow standard for the "storm of record" on MMSD, we must assume that the DNR would impose the same standard on all of the other communities which have had overflows in Wisconsin. The DNR is required by its own rules to apply uniform standards statewide. If the DNR wishes to change those rules, we assume it will follow the statutory rulemaking process.

We urge the DNR to carefully re-evaluate this approach. We question whether such an approach represents the best use of the large taxpayer investment required to meet such standards. The financial impact on MMSD and other treatment plants throughout the state would be tremendous, while at the same time the improvements to water quality are likely to be minimal.

For example, an environmental analysis included with the District's DNR-approved 2010 Facilities Plan showed that a zero overflow objective, compared to the five-year storm objective. for MMSD would have reduced pollutant loadings to Milwaukee-area waterways by less than 0.5% over a modeled period of 1979 through 1995. As the same time, the cost increase would have been nearly $180 million, representing a 100 percent increase in cost to taxpayers.

Spending $180 million on sewers for a one-half of one percent improvement in water quality would not have been prudent, a fact that was acknowledged by the DNR through its approval of the 2010 plan. We believe the DNR should conduct a similar cost/benefit analysis to consider the most cost-effective steps to take to improve water quality before unilaterally adopting a change in the way it regulates sewer overflows. We believe the DNR should be required to justify a change that could lead to huge public expenditures but little payoff for water quality.

Limited taxpayer resources should be used for purposes that will achieve the greatest water quality benefits. The DNR has stated and advocated that polluted runoff "is the greatest cause of water quality problems" to state waterways. Would significant investments by taxpayers such as the $180 million mentioned above, be well spent on building bigger sewers, resulting in almost no improvement in water quality? Or, would such large sums yield higher water quality improvements if spent to address the "greatest cause" of water quality degradation in the state – polluted runoff? These are questions DNR must address.

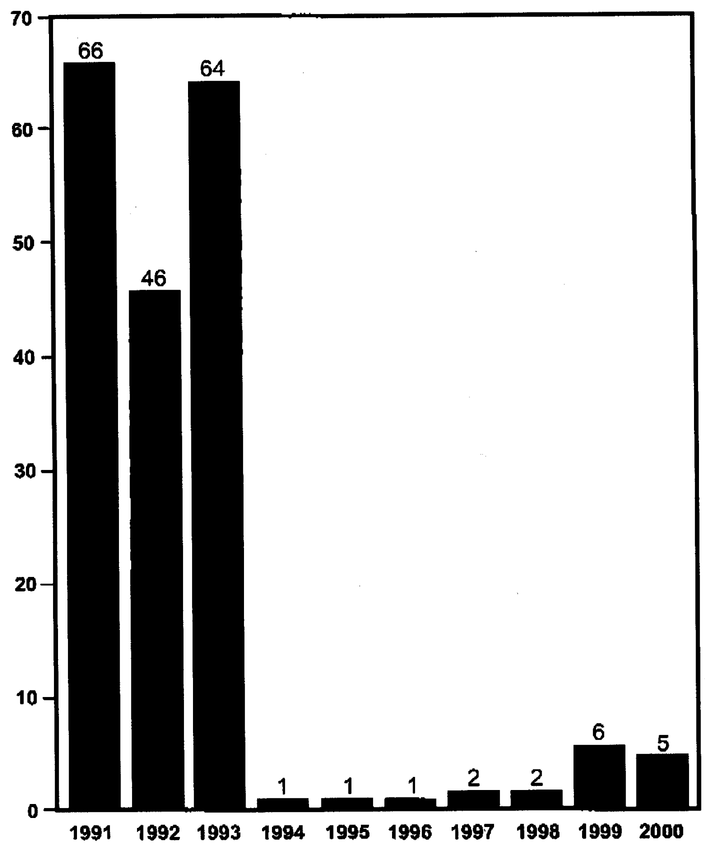
Record Rainfalls

One of the items the report overlooks is the record rainfalls that have hit southeastern Wisconsin in recent years. It is not possible to fully analyze the performance of a sewer system during "wet weather events" without considering the critical factor of rainfall amounts and intensity. As you can see from the attached chart *(see Attachment 5)*, rainfall over the past three years has been significantly above average, highlighted by 2000, which was the third wettest on record, dating back to 1872.

Every time it rains, large amounts of polluted runoff enter the waterways and hamper efforts to improve water quality. Improving water quality was the goal of the Clean Water Act and continues to be the most important issue we face. The public should be provided with better information on the most cost-effective ways to reduce water pollution. Governments need to make fact-based decisions to assure that public expenditures that are made will truly improve water quality.

Attachments
dg/d/mydocs/corres

Number of Overflows Per Year



mmsd
The Clean Water People

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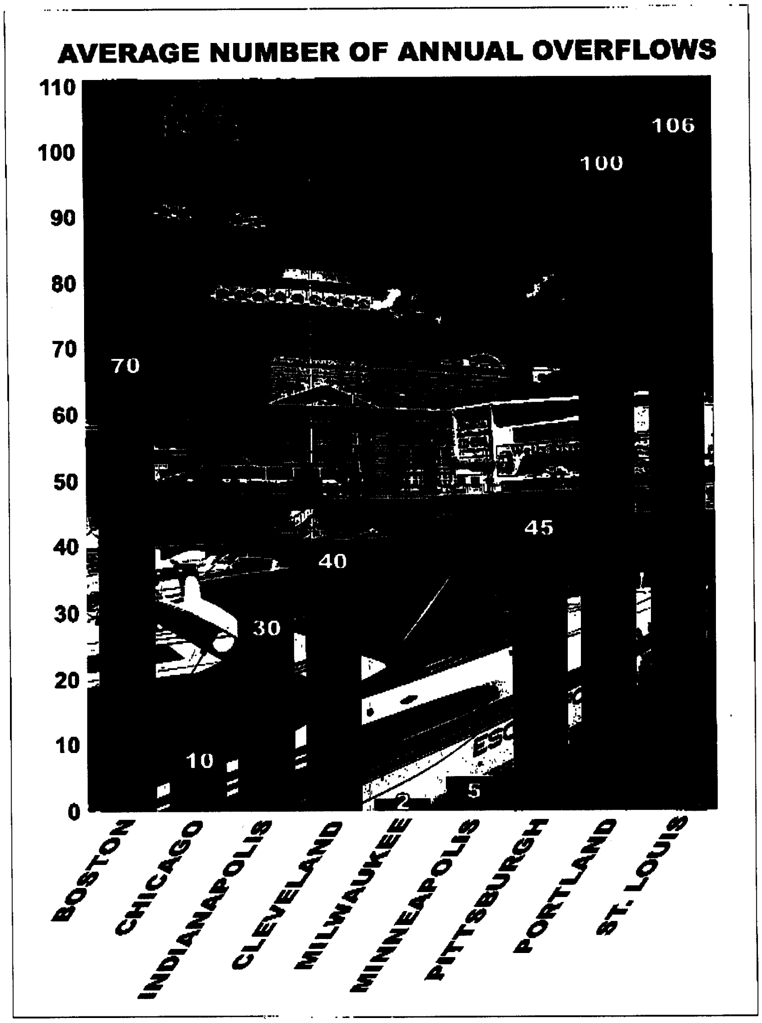
ATTACHMENT 1



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ATTACHMENT 2

CNI NEWSPAPERS
BROWN DEER
HERALD
Wednesday, September 13, 2000 | Your Official Local Newspaper | 1 Section, 72nd Year, No. 37

40 percent of the 128 homes have leaking sewer laterals

Search is on: Leaky sewer pipes the target

DPW is using innovative methods for inspections

By Mary Buckley
Staff Writer

The first phase of a study in the subdivision south of West Dean Road and west of North 60th Street shows that 40 percent of the 128 homes have leaking sewer laterals. The sewer inspection, funded by the Metropolitan Milwaukee Sewerage District, is aimed at determining how much "clear water" — rain or melting snow — enters the sanitary sewer system.

MMSD officials have maintained that excessive water entering the sanitary sewer system is one of the culprits in basement floods throughout the Milwaukee area. Excessive amounts of ground water also have contributed to discharges of raw sewerage into area streams, rivers and Lake Michigan in recent years.

In Brown Deer, the number of homes with leaking pipes may increase after the second stage, now under way, is completed.

Innovative strategies

Dana Faulkner and Dan Bishop, two Brown Deer Department of Public Works employees who specialize in sewer work in the village, are using innovative ways to determine if water is getting into the system.

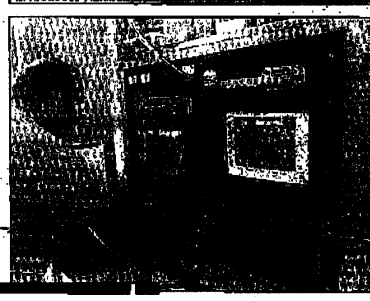
As part of the second phase, Bishop is using a 500-gallon tank of green-dyed water and a hose to pour a stream next to the foundations of houses, right at the point where the sewer pipe leaves the home. If the pipe doesn't leak, there is no problem. But, if the pipe leaks, the water flows into the sanitary sewer and that is the start of a problem that has affected many homeowners in the village and surrounding communities.

Faulkner, using a television camera installed in the sanitary sewer in the street, monitors the flow. If green water starts pouring into the sewer, he and Bishop know they have located a leaking private sewer pipe.

"People who don't have flooded basements don't understand they are contributing to the problem," Faulkner said.

Homes in the subdivision, particularly in the area of North 61st Street and West Tower Avenue where smaller sewer pipes enter the larger connector system, have had repeated basement flooding in recent years during heavy rainstorms.

A 4-inch rainfall in June 1996 flooded streets and basements in the area. That



DPW employee Dana Faulkner (above) lowers a robotic camera into a manhole to inspect the sewers, then (left) reviews the images projected on the screen.

CNI PHOTOS BY CHARLES AUER

Sewers

CONTINUED FROM PAGE 1

scene was repeated with the 11-inch rainfall in June 1997.

Faulkner said he expects it will take several weeks to complete the tests along the foundations.

Earlier, he and Bishop tested the same pipes, but in a different spot — in the ditches where they connect to the sanitary sewers. They used a similar method — injecting dyed water into the ground over the pipe. Fourteen of the pipes leaked heavily, another 20 had what Faulkner called a moderate flow and two had minor leaks.

Since this is a first-time program, Faulkner can't predict what, if any, relationship there will be between the results of the first and second tests, those done at the ditches and at the foundations.

But once those tests are completed, a third test will be done in the houses that showed the worst leaks.

TV cameras to be used

Superintendent of Public Works Larry Neitzel said a small television camera will be inserted into the private pipes from the basements of houses whose owners agree to the test. The camera will allow the DPW to determine the size and type of leaks in the pipes and the best way to repair them.

The $200,000 MMSD grant that is funding the study includes money to repair the leaking pipes.

Once they are repaired, the village and MMSD will have a reliable way to calculate the impact of clear water infiltration into the system.

MMSD Communications Director Mark Kass said the Brown Deer study is one of eight the district is funding.

"We are using different types of neighborhoods," he said.

Similar tests are under way in Elm Grove, with Bayside and Wauwatosa to follow. Other tests are planned for the other four communities.

The age of the homes and soil conditions are thought to be major factors in leaking pipes, and the eight test areas provide different conditions.

In Brown Deer's case, the village had sealed off all leaks on public property. Responding to the 1996 floods, DPW employees replaced leaking manhole covers, sealed the manholes and televised and repaired all public sanitary sewer pipes in the subdivision over a three-year period. But homes in the area continued to flood.

MMSD installed flow monitors in manholes on North 61st Street a year ago. Faulkner said the monitors have collected a wealth of data during rains.

Once the private pipes in the area are repaired, Kass said MMSD engineers expect the monitors will show reduced amounts of water during storms.

"People need to understand (the clear water) has an impact," Kass said.

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ATTACHMENT 3

Milwaukee Metropolitan Sewerage District

Memorandum

DATE: March 15, 2001

TO: Anne Spray Kinney
Executive Director

FROM: Sylvan Leabman
Director of Operations

SUBJECT: Report on Effluent Disinfection, Sampling, and Testing Process at the Jones Island and South Shore Wastewater Treatment Plants

In response to the recent newspaper articles on fecal coliform sampling, the Operations Division staff has prepared the subject report on effluent disinfection, sampling, and testing.

Please contact me should you have questions about the report.

SL:JMJ:nk

Attachment

cc: Mike McCabe

ATTACHMENT 4

An Overview of the Effluent Disinfection Process

Including Sampling and Testing

At Milwaukee's Two Wastewater Treatment Plants

Date: March 2001

An Overview of the Effluent Disinfection Process
Including Sampling and Testing
At Milwaukee's Two Wastewater Treatment Plants

Date: March 2001

1. Department of Natural Resources Permit Requirements

Milwaukee's wastewater treatment plants are regulated under a discharge permit which was issued by the Department of Natural Resources in June 1997 and which expires in March 2002. This permit specifies effluent limitations, monitoring requirements and other conditions for operation of the conveyance and treatment systems. The following requirements apply to the disinfection process including sampling and testing:

- Disinfection of the effluent is to be provided on a continuous year-round basis. Sodium hypochlorite is used for disinfection in Milwaukee's wastewater treatment plants.
- Dechlorination, or removal of all residual chlorine just prior to discharge to the receiving water, is to be provided continuously. Sodium bisulfite is used for dechlorination at Milwaukee's wastewater treatment plants.
- The DNR requires sampling to demonstrate the effectiveness of the chlorination/dechlorination processes. One of the required tests is a fecal coliform test. Effluent samples for analysis of fecal coliform are to be collected three times per week. While the permit does not specify a time of sampling, sample collection and analysis is to follow methods prescribed by the Department of Natural Resources with analysis to be performed by a certified laboratory. In terms of methods, an instantaneous or "grab" sample is required.
- The limit set in the permit by the Department of Natural Resources is 400 fecal coliform organisms per 100 milliliters of effluent. The DNR permit and State law require the use of a monthly geometric mean.
- The permit states that, if the permitee monitors any pollutant more frequently than required in the permit, the results of such monitoring are to be included on the report submitted to the Department of Natural Resources (Discharge Monitoring Report, WDNR Form #3200-28). While threes samples per week are required to be taken, it is allowable to collect a greater number of samples. Duplicate or split samples created in the Laboratory for quality control purposes are not considered "more frequent monitoring" under the permit requirements.

2. United Water Services Agreement for Operations and Maintenance Services

The Agreement between United Water Services and the District specifies an effluent limit (monthly geometric mean) for fecal coliform that is more stringent than the discharge permit. United Water Services is required to meet a level of 100 fecal coliform organisms per 100 milliliters of effluent. This more stringent limit was based on the quality of effluent typically achieved by MMSD in the years just prior to the beginning of the contractual Agreement for Operations and Maintenance Services with United Water Services.

3. Description of Disinfection Process and Method of Control

Disinfection is commonly used at treatment plants to improve effluent quality so as not to adversely affect other uses of the receiving water body, such as bathing, or as a source of drinking water. Secondary effluent without disinfection may contain thousands to millions of fecal coliform bacteria, as well as other types of bacteria. The source of fecal coliform bacteria is enteric waste from warm-blooded animals, with human waste being the predominant source. Fecal coliform bacteria, however, are not in and of themselves disease causing or pathogenic, but are an indicator of the possible presence of pathogenic bacteria and viruses of enteric origin. Fecal coliforms are analyzed since analysis for the actual pathogens is more difficult. In the nineteenth century, before wastewater treatment, and chlorination of drinking water, diseases such as typhoid fever and cholera were common in cities. While beneficial, disinfection may have some environmental consequence. Possible adverse effects of chlorine disinfection include increasing the salinity of the receiving water body, causing toxicity to fish and aquatic life, and forming carcinogenic compounds known as chlorinated hydrocarbons. Toxicity to fish and aquatic life has been documented as the most serious potential problem. This potential problem is mitigated in MMSD's discharge permit by the requirement to dechlorinate (no detectable chlorine) the effluent prior to discharge to Lake Michigan. Dechlorination is achieved by mixing sodium bisulfite with the chlorinated effluent, thereby neutralizing any remaining chlorine prior to discharge into Lake Michigan.

The overall treatment process, including the disinfection process, is very similar at the Jones Island and South Shore plants. Disinfection, using chlorination and dechlorination, has been successfully used for many years at Jones Island and South Shore. In 2000 a $6.2 million capital improvement project was completed to improve the application and control system for the disinfection process and to convert from gaseous to liquid chemical forms. Strong liquid bleach, or sodium hypochlorite, is now used instead of chlorine gas. Liquid bleach is equally effective as chlorine gas but is much safer to store and use. The conversion from gaseous to the liquid form was made in June 1999. The liquid chlorination-dechlorination systems as they now exist at Jones Island and South Shore are state-of-the-art and should provide excellent disinfection and effluent quality for many years.

The most important factors in chlorine disinfection are the amount of the chemical added and the contact time of the chemical with the water. In terms of achieving the same efficiency, the dosage or amount added can be decreased if the length of the contact time is increased. At the treatment plants large serpentine contact tanks are used to provide a long contact time. For example, at Jones Island, for the calendar year 2000 average plant flow of 111 MGD, a contact time of about 2 hours is provided before dechlorination and discharge to Lake Michigan (*Jones Island Operation and Maintenance Manual*, Vol.11, Table 3-1). As part of the 1999 upgrade, chlorine is now added using high-speed mixers instead of static diffusers. The use of these mixers was an innovation suggested by United Water Services. These mixers decrease the amount of chlorine required by providing more effective contact between the chlorine and the bacteria.

The operating procedure at the treatment plants involves a two-part control system. First, the amount of chlorine added is paced with the flow of effluent. As the effluent flow increases, the amount of chlorine added is automatically increased. The rate of application may be periodically adjusted based on effluent quality, but it is generally in the range of from 2 to 3 milligrams of chlorine per liter (mg/l) of water. The second part of the control involves continuously measuring the amount of chlorine remaining after ten minutes of contact time (the ten-minute residual). Operating experience indicates that about 0.5 to 1.5 milligrams per liter (mg/l) of chlorine must remain and be measured at this point for effective disinfection to occur. Data for the entire disinfection system, such as chlorine addition and chlorine residual, is continuously monitored and recorded on a computerized Supervisory Control and Data Acquisition (SCADA) system.

4. Fecal Coliform Sampling Time

A question has been raised regarding the appropriate time to collect the fecal coliform sample at the treatment plants. Presently, the United Water Services operator usually collects the sample between 3 and 5 AM. The reason that this is done is a matter of efficiency and logistics. These specially collected samples, along with other 24-hour composite samples collected from the previous day, are delivered to the MMSD Laboratory by 6 AM. In accordance with good sampling practice, a chain of custody sheet is delivered with each sample. The chain of custody sheet records information such as sample identification, name of person collecting the sample, time and date of sample collection, plant flow at time of collection, and sample preservation method.

It has been suggested that these samples, collected at 3-5 AM, are not representative of disinfection performance for the following reasons:

- Treatment plant flow is lower than normal
- Normal daytime discharges are not occurring

Upon a detailed review of available data, neither of these arguments has merit.

A review of the data shows that the treatment plant flow at 3 AM to 5 AM is not lower than normal but is similar to and often higher than the average flow for the day. Table One below compares, for Jones Island, the flow rate at the time the fecal coliform sample was collected with the average flow for the day. For the 160 daily samples, the average flow when the sample was collected was <u>120</u> million gallons per day compared to the average flow for the day of <u>109</u> million gallons. When looking at individual days, of the 160 daily samples, the early morning flow was higher than the average flow for 109 days; was lower for 46 days; and was the same for 5 days. So if flow was the sole variable in disinfection efficiency, the current sampling is not being

Table One. Comparison of Jones Island Flow When Sample Collected vs. Average Daily Flow

Sample Date	Sample Time	Flow (MGD) at Sampling	FC/100 ML	Average Daily Flow (MGD)
3-Jan-00	3:00AM	110	500	88
5-Jan-00	4:40AM	108	80	90
7-Jan-00	4:40AM	105	500	89
10-Jan-00	4:40AM	115	50	107
12-Jan-00	2:30AM	114	23	86
14-Jan-00	4:40AM	109	21	89
17-Jan-00	3:30AM	95	11	89
19-Jan-00	3:15AM	112	4	88
21-Jan-00	4:50AM	90	50	86
24-Jan-00	3:57AM	102	110	83
26-Jan-00	4:10AM	105	30	85
28-Jan-00	4:12AM	110	50	88
31-Jan-00	4:05AM	64	2	61
2-Feb-00	4:11AM	86	17	86
4-Feb-00	4:15AM	72	7	86
7-Feb-00	4:10AM	65	22	75
9-Feb-00	3:50AM	114	29	80
11-Feb-00	3:55AM	104	30	82
14-Feb-00	4:10AM	60	8	68
16-Feb-00	3:30AM	94	29	88
18-Feb-00	4:08AM	88	23	92
21-Feb-00	4:11AM	98	170	93
23-Feb-00	4:10AM	143	60	135
25-Feb-00	1:00AM	158	16000	129
28-Feb-00	4:40AM	66	13	79
1-Mar-00	3:45AM	75	13	75
3-Mar-00	3:30AM	108	23	83
6-Mar-00	3:30AM	65	50	75
8-Mar-00	3:30AM	88	7	94
10-Mar-00	4:16AM	88	36	97
13-Mar-00	3:15AM	118	27	43
15-Mar-00	3:40AM	90	14	85
17-Mar-00	5:00AM	82	13	82
20-Mar-00	5:00AM	87	11	154
22-Mar-00	3:00AM	141	30	104
24-Mar-00	3:30AM	112	13	107
27-Mar-00	3:50AM	83	13	90
31-Mar-00	4:20AM	78	30	93
3-Apr-00	3:50AM	72	280	87
5-Apr-00	3:55AM	115	50	88
7-Apr-00	4:17AM	69	23	113
10-Apr-00	3:50AM	82	220	93
12-Apr-00	4:23AM	83	500	99
14-Apr-00	4:30AM	91	50	96
17-Apr-00	4:15AM	78	23	93
19-Apr-00	3:50AM	128	11	130
21-Apr-00	4:40AM	293	230	255
24-Apr-00	4:18AM	161	11	156
26-Apr-00	4:15AM	137	11	119
28-Apr-00	4:10AM	129	4	106
1-May-00	3:30AM	116	17	107
3-May-00	3:00AM	137	34	97
5-May-00	4:35AM	90	2	97
8-May-00	2:30AM	112	4	102
10-May-00	4:00AM	126	9	131
12-May-00	3:20AM	325	2200	215
15-May-00	3:40AM	90	500	102
17-May-00	2:50AM	118	22	137
19-May-00	2:25AM	300	3000	300
22-May-00	3:40AM	202	130	214
24-May-00	2:00AM	145	8	129
26-May-00	3:00AM	146	11	101
29-May-00	3:40AM	143	80	127
31-May-00	3:50AM	116	9	151
2-Jun-00	4:07AM	280	23	256
5-Jun-00	3:30AM	202	130	207
7-Jun-00	3:30AM	143	21	130
9-Jun-00	4:34AM	151	22	109
12-Jun-00	4:25AM	110	130	167
14-Jun-00	3:50AM	102	280	114
16-Jun-00	4:05AM	135	27	99
19-Jun-00	4:25AM	125	110	100
21-Jun-00	4:10AM	140	9	111
23-Jun-00	3:50AM	117	170	94
26-Jun-00	4:35AM	112	39	86
28-Jun-00	4:25AM	117	58	116
30-Jun-00	4:15AM	113	130	97
3-Jul-00	2:00AM	278	1300	238
5-Jul-00	2:00AM	206	84	190
7-Jul-00	4:10AM	153	30	111
10-Jul-00	4:40AM	75	500	120
12-Jul-00	3:00AM	130	3000	104
14-Jul-00	2:20AM	130	800	115
17-Jul-00	4:20AM	114	300	94

Table One (continued). Comparison of Jones Island Flow When Sample Collected vs. Average Daily Flow

Sample Date	Sample Time	Flow (MGD) at Sampling	FC/100 ML	Average Daily Flow (MGD)
19-Jul-00	2:00AM	128	50	91
20-Jul-00	2:10AM	126	130	93
21-Jul-00	3:12AM	98	280	90
22-Jul-00	2:20AM	97	26	90
23-Jul-00	3:00AM	79	27	78
24-Jul-00	3:00AM	79	220	84
25-Jul-00	3:00AM	85	30	90
26-Jul-00	3:00AM	87	2	86
27-Jul-00	3:30AM	112	14	126
28-Jul-00	3:30AM	80	2	107
29-Jul-00	3:40AM	90	13	120
30-Jul-00	2:20AM	89	8	76
31-Jul-00	3:35AM	151	1300	105
2-Aug-00	3:50AM	118	110	107
4-Aug-00	4:20AM	118	1300	89
7-Aug-00	4:25AM	159	280	191
9-Aug-00	4:20AM	193	220	139
11-Aug-00	5:00AM	100	500	102
14-Aug-00	4:22AM	115	27	98
16-Aug-00	4:00AM	116	8	92
18-Aug-00	4:50AM	165	1300	158
21-Aug-00	4:25AM	109	50	97
23-Aug-00	4:41AM	113	50	97
24-Aug-00	4:15AM	83	2	90
25-Aug-00	4:20AM	78	2	93
26-Aug-00	4:00AM	76	4	128
28-Aug-00	3:10AM	86	11	91
30-Aug-00	3:24AM	78	2	91
1-Sep-00	3:45AM	105	17	95
4-Sep-00	3:30AM	74	30	100
6-Sep-00	4:00AM	83	4	91
8-Sep-00	4:55AM	168	8	131
13-Sep-00	3:15AM	235	170	229
15-Sep-00	3:00AM	238	2400	214
18-Sep-00	3:30AM	160	30	144
20-Sep-00	3:30AM	165	2	99
22-Sep-00	3:25AM	120	4	153
25-Sep-00	4:00AM	200	80	152
27-Sep-00	3:40AM	163	350	126

Sample Date	Sample Time	Flow (MGD) at Sampling	FC/100 ML	Average Daily Flow (MGD)
29-Sep-00	2:30AM	128	14	96
2-Oct-00	4:00AM	126	11	97
4-Oct-00	4:50AM	120	8	120
6-Oct-00	4:30AM	156	30	109
9-Oct-00	4:00AM	116	23	92
11-Oct-00	4:15AM	111	2	92
13-Oct-00	4:35AM	111	2	90
16-Oct-00	4:23AM	104	6	84
18-Oct-00	4:13AM	119	27	84
20-Oct-00	3:50AM	109	17	84
23-Oct-00	4:05AM	105	14	93
25-Oct-00	3:56AM	109	17	85
27-Oct-00	4:00AM	105	8	84
30-Oct-00	4:00AM	101	13	79
1-Nov-00	3:40AM	108	13	92
3-Nov-00	4:25AM	100	4	94
6-Nov-00	5:00AM	115	500	104
8-Nov-00	3:30AM	134	1300	119
10-Nov-00	3:15AM	183	1700	129
13-Nov-00	5:00AM	118	13	94
15-Nov-00	5:00AM	119	4	97
17-Nov-00	2:30AM	120	17	95
20-Nov-00	5:00AM	97	11	90
22-Nov-00	5:00AM	67	4	72
24-Nov-00	3:30AM	109	17	85
27-Nov-00	3:00AM	120	4	92
29-Nov-00	5:00AM	119	23	150
1-Dec-00	5:00AM	120	22	95
4-Dec-00	2:30AM	116	50	83
6-Dec-00	4:00AM	108	8	83
8-Dec-00	4:15AM	105	4	82
11-Dec-00	4:20AM	99	11	81
15-Dec-00	7:15AM	55	4	74
20-Dec-00	4:11AM	105	5000	76
27-Dec-00	4:21AM	95	300	82
29-Dec-00	4:46AM	99	500	78
Average:	MGD	120		109
No. Cases	Greater	109		46
No. Cases	Equal		5	

perfomed at the lowest flow point of the day. However, it should be pointed out that the amount of chlorine added is automatically increased when the flow increases. At both plants there is more than adequate capacity available for adding chlorine, and in fact substantially more than required by the maximum wastewater plant flow capacities.

The same phenomenon (flow at time of sampling greater than average flow) is found at the South Shore plant. At South Shore, the flow rate at the time the fecal coliform sample was compared with the average flow for the day (see Table Two). For the 156 South Shore daily samples, the average flow when the sample was collected was <u>118</u> million gallons per day compared to the average flow for the day of <u>105</u> million gallons. When looking at individual days, of the 156 daily samples, the early morning flow was higher than the average flow for 134 days; was lower for 21 days; and was the same for 1 day.

Table Two. Comparison of South Shore Flow When Sample Collected vs. Average Daily Flow

Sample Date	Sample Time	Flow (MGD) at Sampling	FC/100 ML	Average Daily Flow (MGD)
3-Jan-00	3:50 AM	76	50	65
5-Jan-00	3:58 AM	76	14	71
7-Jan-00	3:58 AM	75	30	69
10-Jan-00	4:01 AM	79	11	70
12-Jan-00	4:02 AM	83	27	80
14-Jan-00	3:55 AM	78	34	75
17-Jan-00	3:50 AM	79	11	72
19-Jan-00	4:02 AM	74	30	73
21-Jan-00	3:15 AM	74	30	70
24-Jan-00	3:15 AM	77	50	69
26-Jan-00	3:00 AM	74	30	68
28-Jan-00	3:30 AM	72	70	68
31-Jan-00	3:15 AM	90	17	81
2-Feb-00	3:15 AM	72	27	74
4-Feb-00	3:00 AM	95	34	71
7-Feb-00	3:15 AM	82	30	67
9-Feb-00	3:00 AM	75	13	78
11-Feb-00	3:00 AM	77	14	71
14-Feb-00	3:00 AM	86	80	68
16-Feb-00	3:00 AM	91	23	88
18-Feb-00	3:00 AM	88	17	90
21-Feb-00	3:00 AM	88	80	79
23-Feb-00	3:56 AM	180	170	109
1-Mar-00	3:47 AM	134	13	107
3-Mar-00	4:00 AM	110	12	107
6-Mar-00	3:40 AM	117	110	97
8-Mar-00	3:35 AM	101	17	108
10-Mar-00	3:57 AM	138	300	85
13-Mar-00	3:10 AM	105	800	98
15-Mar-00	4:00 AM	97	13	91
17-Mar-00	3:55 AM	96	300	89
20-Mar-00	3:53 AM	126	500	131
22-Mar-00	3:45 AM	110	22	104
24-Mar-00	3:45 AM	101	17	98
27-Mar-00	3:45 AM	125	4	104
29-Mar-00	3:30 AM	98	4	90
31-Mar-00	3:25 AM	87	2	82
3-Apr-00	3:15 AM	92	11	82
5-Apr-00	3:00 AM	86	300	81
7-Apr-00	3:17 AM	100	23	100
10-Apr-00	3:30 AM	165	80	146
12-Apr-00	3:30 AM	117	130	106
14-Apr-00	3:00 AM	105	9	102
17-Apr-00	3:00 AM	97	2	92
19-Apr-00	3:15 AM	95	7	109
21-Apr-00	3:00 AM	300	2300	297
24-Apr-00	3:05 AM	187	8	165
26-Apr-00	3:00 AM	140	4	128
28-Apr-00	3:00 AM	120	4	111
2-May-00	3:05 AM	110	2	101
3-May-00	3:15 AM	102	4	95
5-May-00	3:55 AM	96	4	91
8-May-00	3:15 AM	93	2	99
10-May-00	3:15 AM	261	22	197
12-May-00	3:54 AM	162	130	251
15-May-00	3:59 AM	126	2	119

Table Two (continued). Comparison of South Shore Flow When Sample Collected vs. Average Daily Flow

Sample Date	Sample Time	Flow (MGD) at Sampling	FC/100 ML	Average Daily Flow (MGD)
17-May-00	3:10 AM	118	4	111
19-May-00	3:05 AM	279	130	291
22-May-00	3:50 AM	216	17	202
24-May-00	3:10 AM	160	14	149
26-May-00	3:01 AM	121	23	117
29-May-00	3:45 AM	193	110	172
31-May-00	3:15 AM	169	2	151
2-Jun-00	3:00 AM	299	800	301
5-Jun-00	3:00 AM	292	110	220
7-Jun-00	3:00 AM	163	4	153
9-Jun-00	3:05 AM	133	17	126
12-Jun-00	3:40 AM	119	30	136
14-Jun-00	3:15 AM	158	17	152
16-Jun-00	3:00 AM	131	13	128
19-Jun-00	3:10 AM	104	80	97
21-Jun-00	4:15 AM	125	13	115
23-Jun-00	3:35 AM	102	80	98
26-Jun-00	3:03 AM	107	30	100
28-Jun-00	3:03 AM	94	170	97
30-Jun-00	3:00 AM	103	2	93
3-Jul-00	3:15 AM	320	230000	167
5-Jul-00	3:15 AM	152	23	129
7-Jul-00	4:10 AM	161	30	135
10-Jul-00	3:57 AM	136	4	155
12-Jul-00	3:12 AM	130	70	122
17-Jul-00	3:11 AM	101	2	98
19-Jul-00	3:00 AM	99	8	92
21-Jul-00	2:15 AM	128	8	92
24-Jul-00	3:00 AM	91	2	86
26-Jul-00	3:00 AM	91	30	94
28-Jul-00	3:12 AM	134	2	141
31-Jul-00	3:30 AM	108	17	115
2-Aug-00	3:00 AM	115	17	88
4-Aug-00	4:00 AM	93	7	84
7-Aug-00	3:09 AM	226	11	153
9-Aug-00	3:00 AM	142	9	107
11-Aug-00	3:00 AM	110	500	121
14-Aug-00	3:00 AM	102	17	83
16-Aug-00	3:00 AM	101	11	83
18-Aug-00	3:20 AM	216	50	190
21-Aug-00	3:00 AM	118	30	95
23-Aug-00	3:10 AM	125	70	104
25-Aug-00	3:30 AM	78	80	83
28-Aug-00	3:12 AM	106	27	91
30-Aug-00	3:03 AM	97	70	82
1-Sep-00	3:44 AM	96	17	83
4-Sep-00	3:50 AM	113	30	81
6-Sep-00	3:10 AM	95	30	78
8-Sep-00	8:10 AM	94	2400	122
11-Sep-00	3:47 AM	149	130	113
13-Sep-00	3:10 AM	226	2	209
15-Sep-00	3:10 AM	225	280	211

Sample Date	Sample Time	Flow (MGD) at Sampling	FC/100 ML	Average Daily Flow (MGD)
18-Sep-00	3:48 AM	157	170	142
20-Sep-00	3:09 AM	124	230	111
22-Sep-00	3:10 AM	115	50	100
25-Sep-00	3:46 AM	182	50	161
27-Sep-00	3:48 AM	133	23	121
27-Sep-00	10:45 AM	118	14	121
29-Sep-00	3:10 AM	120	2	103
30-Sep-00	3:10 AM	114	4	95
1-Oct-00	3:10 AM	110	8	93
2-Oct-00	3:10 AM	107	14	94
4-Oct-00	3:00 AM	112	13	97
6-Oct-00	3:15 AM	131	11	101
9-Oct-00	3:13 AM	101	140	87
11-Oct-00	3:10 AM	121	280	93
13-Oct-00	3:25 AM	90	13	75
16-Oct-00	4:00 AM	89	30	69
18-Oct-00	3:15 AM	87	30	73
20-Oct-00	3:15 AM	86	22	73
23-Oct-00	3:14 AM	87	80	73
25-Oct-00	3:12 AM	89	7	74
27-Oct-00	3:15 AM	86	8	75
30-Oct-00	3:15 AM	80	50	66
1-Nov-00	3:07 AM	81	13	68
3-Nov-00	3:14 AM	86	21	69
6-Nov-00	3:15 AM	89	21	66
8-Nov-00	3:05 AM	100	11	79
10-Nov-00	3:05 AM	150	800	117
13-Nov-00	3:15 AM	101	19	84
15-Nov-00	3:00 AM	93	300	81
17-Nov-00	3:05 AM	94	30	81
20-Nov-00	3:48 AM	90	50	75
22-Nov-00	3:55 AM	89	26	94
24-Nov-00	3:05 AM	83	33	66
27-Nov-00	3:05 AM	91	300	77
29-Nov-00	3:52 AM	85	26	80
1-Dec-00	3:44 AM	102	800	90
4-Dec-00	3:00 AM	99	300	84
6-Dec-00	3:35 AM	90	130	82
8-Dec-00	3:10 AM	90	21	80
11-Dec-00	3:09 AM	91	4	76
13-Dec-00	3:02 AM	87	50	74
15-Dec-00	3:10 AM	97	70	92
18-Dec-00	4:55 AM	95	220	86
20-Dec-00	9:45 AM	89	17	73
22-Dec-00	3:52 AM	85	30	70
25-Dec-00	3:30 AM	82	4	70
27-Dec-00	3:05 AM	88	2	69
29-Dec-00	3:20 AM	91	11	30

Average MGD	118		105
No. Cases Greater	104		2[illegible]
No. Cases Equal		1	

In a large collection system such as Milwaukee's, the time of travel for wastewater, while variable, is generally quite long. Depending on where wastewater is discharged, it would take anywhere from 30 minutes to 8 hours to reach the Jones Island Plant. An "average" distance from the Jones Island Plant might be about 6 miles and this would yield an "average" travel time for conveyance in the sewer of about 3 hours. In addition, the treatment of wastewater takes about 12 hours. Therefore, there is a lag of about 15 hours from the time wastewater is discharged by the user to the time it is sampled, just before being discharged to Lake Michigan. Therefore, effluent sampled at 3 AM represents wastewater that was discharged 15 hours earlier, or at about noon on the previous day. The South Shore plant serves suburban areas from Muskego to Germantown. Travel times to the South Shore plant are considerably longer and more variable than for Jones Island. Therefore, the day/night flow at South Shore is less variable than at Jones Island.

Finally, previously collected data were analyzed to determine whether samples collected at 3-5 AM tested lower for fecal coliform bacteria than samples collected on the same day but later in the morning. These data are shown in Table Three below. A statistical analysis of these data was performed to compare the averages. It was found that there was no significant difference between the averages for the two sampling times, even though the geometric average was slightly higher for the early samples. This was true for both the Jones Island and South Shore Plants. This suggests randomness of the data and implies that both sample times are representative.

Table Three. Comparison of Data Collected on Same Day but at Different Times

Jones Island

Sample Date	Time (AM)	FC per 100mL	Time (AM)	FC per 100mL
9/6/00	4:00	4	10:00	30
9/8/00	4:55	8	9:02	1300
9/13/00	3:15	170	9:30	3000
9/15/00	3:00	2400	8:54	130
9/18/00	3:30	30	10:34	27
9/20/00	3:30	2	10:10	2
9/22/00	3:25	4	11:25	2
9/25/00	4:00	80	9:40	30
9/27/00	3:40	350	9:25	4
10/2/00	4:00	11	9:40	8
10/4/00	4:50	8	9:08	2
11/29/00	5:00	23	9:40	70
12/1/00	5:00	22	9:15	17
12/4/00	2:30	50	9:49	2
12/6/00	4:00	8	9:30	2
12/8/00	4:15	4	9:54	8
12/11/00	4:20	11	11:30	17
12/15/00	7:15	4	10:20	2
Average-geometric		20		16

South Shore

Sample Date	Time (AM)	FC per 100mL	Time (AM)	FC per 100mL
9/6/00	3:10	30	8:30	23
9/8/00	8:10	2400	8:16	80
9/11/00	3:47	130	8:12	70
9/13/00	3:10	2	8:21	14
9/15/00	3:10	280	7:46	1700
9/18/00	3:48	170	9:13	230
9/20/00	3:09	230	7:50	4
9/25/00	3:46	50	8:23	50
9/27/00	3:48	23	8:00	500
10/2/00	3:10	14	8:25	2
10/4/00	3:00	13	7:39	8
11/29/00	3:52	26	8:10	80
12/4/00	3:00	300	8:15	140
12/6/00	3:35	130	8:12	70
12/11/00	3:09	4	9:07	17
Average-geometric		56		[illegible]

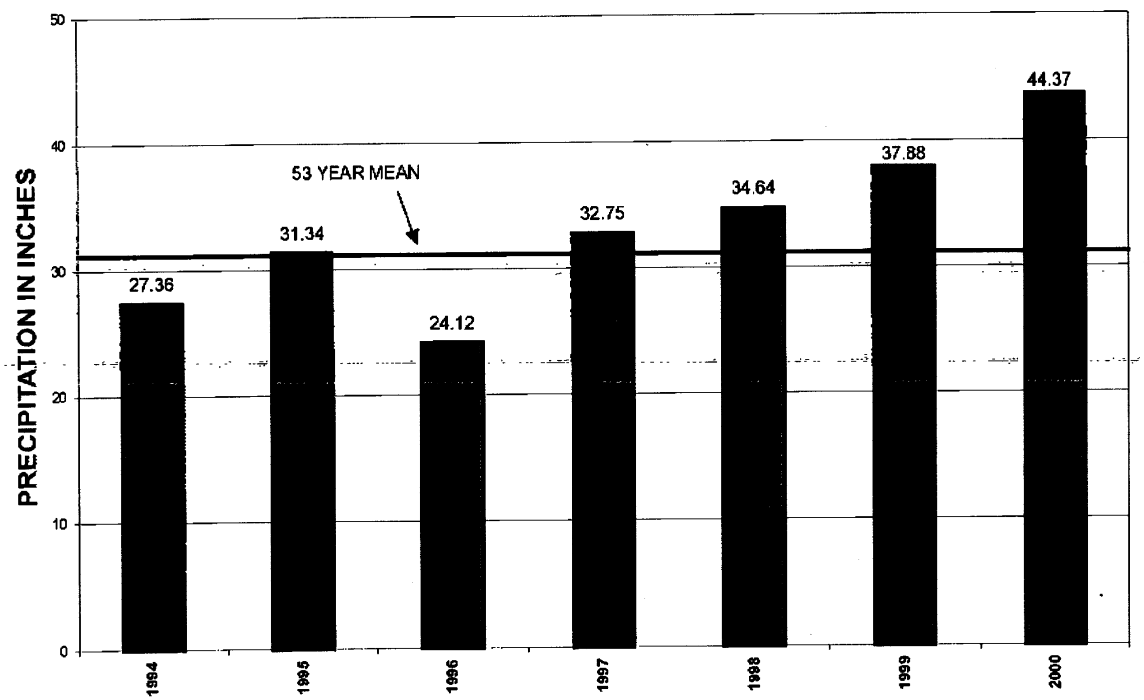
5. Laboratory Analysis of Duplicate Samples

The MMSD Laboratory performs quality control of the frequency and type required by the Department of Natural Resources and EPA guidelines. This includes a duplicate analysis, which is performed at a minimum, on every tenth sample. Duplicates may be run more frequently depending upon how analyses are scheduled. This duplicate analysis is performed to assess the precision of the analysis and ensure that the measurement variability is within the expected norm. The standard practice is to designate splits as being either original or duplicate before the analysis is begun. The value obtained for the original sample is reported as such and the duplicate values are used solely for quality control. If the value obtained for the duplicate sample is outside of preset quality control limits for batch precision, corrective action is initiated for quality control purposes. This procedure, standard to the environmental testing industry, is the standard protocol in the MMSD laboratory and is consistent with Department of Natural Resources and EPA guidelines.

6. Conclusion on Fecal Coliform Bacteria Sample Time

A review of facts shows that a 3-5 AM fecal coliform sample time is conservatively representative and appropriate for the Milwaukee system. The 3-5 AM effluent flow is actually slightly higher than the average day flow and this period does capture active times of human waste contribution.

NOAA
LOCAL CLIMATOLOGICAL DATA
CALENDAR YEAR 1999 THRU DECEMBER 2000



ATTACHMENT 5